

Robust High Temperature Environmental Barrier Coating System for Ceramic Matrix Composite Gas Turbine Components using Affordable Processing Approach, Phase II

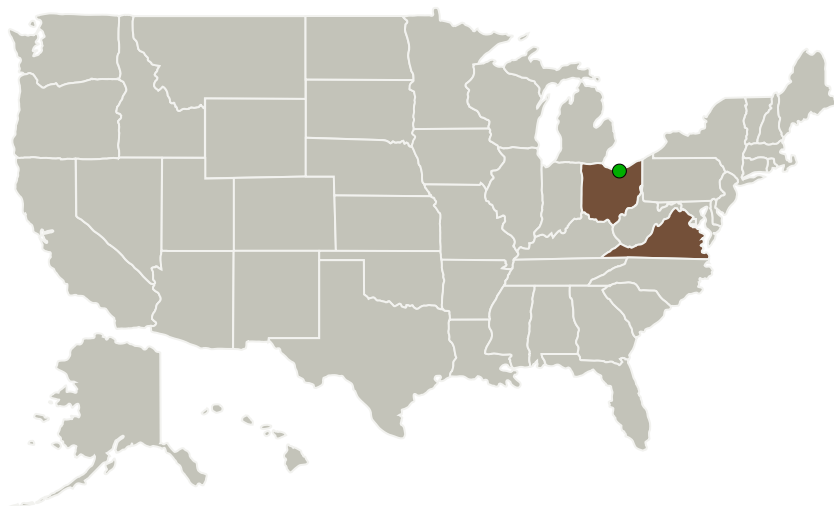
Completed Technology Project (2015 - 2018)



Project Introduction

Research is proposed to demonstrate the use of advanced manufacturing techniques to enable the affordable application of multi-functional thermal/environmental barrier coatings (T/EBCs) having enhanced resistance to high temperature combustion environments. T/EBCs are envisioned to protect the surface of Si-based ceramics against moisture-assisted, oxidation-induced ceramic recession. Current T/EBC systems have been demonstrated in long time exposures at ~2400 F substrate temperatures. However, their use at elevated temperatures (i.e., 2700 F substrate temperatures) is limited by the low temperature stability and high diffusion activity of current T/EBC materials. One approach to increase the temperature capability of these systems is the incorporation of multilayered T/EBC designs. In this effort, enhanced processing techniques will be employed to demonstrate the manufacture of robust T/EBC systems using a physical vapor deposition based processing approach which enables improved coating adhesion and advanced coating architectural, compositional, and microstructural control, as well as non-line-of-sight (NLOS) deposition. During this proposed Phase II effort, processing/property/performance relationships for the manufacture of the novel coating architectures will be determined. Optimized processing approaches will then be used to demonstrate the deposition of high temperature capable T/EBC systems coating onto components of interest to gas turbine engine manufacturers.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Directed Vapor Technologies International, Inc	Lead Organization	Industry	Charlottesville, Virginia
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Virginia

Project Transitions

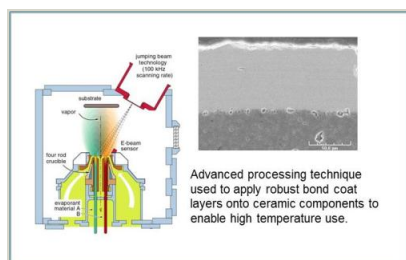
▶ **May 2015:** Project Start

✓ **September 2018:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137482>)

Images



Briefing Chart

Robust High Temperature Environmental Barrier Coating System for Ceramic Matrix Composite Gas Turbine Components using Affordable Processing Approach Briefing Chart (<https://techport.nasa.gov/image/131471>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Directed Vapor Technologies International, Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

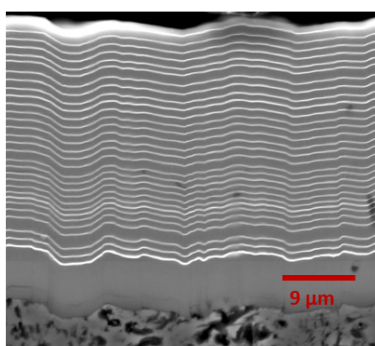
Carlos Torrez

Principal Investigator:

Balvinder Gogia

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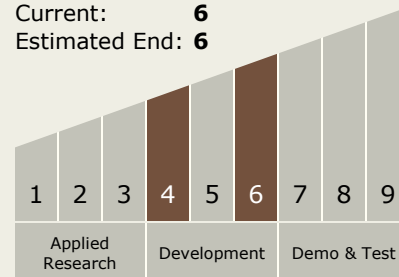
Advanced vapor processing technique is used to apply robust, high temperature environmental coatings.

Final Summary Chart Image

Robust High Temperature Environmental Barrier Coating System for Ceramic Matrix Composite Gas Turbine Components using Affordable Processing Approach, Phase II Project Image
(<https://techport.nasa.gov/image/136450>)

Technology Maturity (TRL)

Start: 4
Current: 6
Estimated End: 6



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - TX12.1 Materials
 - TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System